Pergamon

J. Quant. Spectrosc. Radiat. Transfer Vol. 54, No. 5, pp. 827–835, 1995

0022-4073(95)00092-5
0022-4073/95 $9.50 + 0.00

EXPERIMENTAL STARK PARAMETERS OF $3s^2S$-$3p^2P^0$ MULTIPLET LINES OF SINGLY IONIZED CARBON

E. V. SARANDAEV and M. Kh. SALAKHOV†
Department of Physics, Kazan State University, 420008 Kazan, Tatarstan, Russia

(Received 6 December 1994)

Abstract—Under an impulsive capillary discharge the Stark widths and shifts of singly ionized carbon CII 6578 Å and CII 6583 Å spectral lines have been measured. The electron density has been measured using the hydrogen H_α line width ($N_e = 2.21 \cdot 10^{17}\,cm^{-3}$). The plasma temperature has been determined from the relative intensities of copper CuII 2545 Å and CuII 2490 Å ionic lines ($T = 22{,}000$ K). The dependencies for estimating the Stark widths and shifts of singly ionized carbon lines have been proposed. The measured Stark parameters are compared both with the literature data and with the values calculated using the proposed dependencies.

1. INTRODUCTION

Stark parameters of spectral lines are needed for solving some problems of astrophysics, laboratory plasma diagnostics and for checking the present theories of broadening. A number of experimental papers[1–7] deal with studying widths and shifts of singly ionized carbon spectral lines. They demonstrate that in general there is satisfactory agreement between the experimental data and theoretical calculations. However, a large discrepancy is observed for the negative shifts of CII 6578 Å and CII 6583 Å lines: the experimental values[6] are about three times smaller than theoretical data.[8] The aim of this work is to study Stark parameters, the shifts of these carbon lines in particular, under pulsed capillary discharge. On the basis of the approach,[9] the dependencies for estimating the Stark widths and shifts of CII spectral lines are obtained as well.

2. EXPERIMENTAL APPARATUS

To measure Stark parameters we used the apparatus described in Ref. 10. The impulse discharge in the textolite capillary was used as the light source. The bronze electrode served as a cathode. Under high temperature carbon was evaporated from the internal walls of the capillary and was introduced into the discharge channel. The discharge circuit of the light source consisted of a 1800 μF capacitor and a 500 μH inductance. The studied spectra and the hydrogen H_α line (for measuring electron density) were photographed using a DFS-8 spectrograph with inverse linear dispersion 3 Å/mm. The registration of both spectra on one photograph enabled us to avoid the error due to the inaccuracy in alignment of optics, which usually arises when spectra are registered using two different spectrographs.[10] Spectra were photographed in the cross-section with time resolution 0.15 msec and total duration of the discharge about 6 msec. After the studied lines were photographed, the narrow copper lines CuI 3247 Å and CuI 3274 Å radiated by an electrodeless high-frequency lamp and registered in the second order were superimposed on the photograph. These lines served as references for measuring the line shift and for precision measuring the inverse linear dispersion of the apparatus in this spectral region.

†To whom all correspondence should be addressed.